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ABSTRACT

A review of literature indicates that many so-called reading miscues could well be the result of ocular defects rather than learning disabilities, and that there is a need for adequate screening programs at the earliest possible age so that these defects may be treated when they exist. The question is raised as to how many children designated as having learning or reading problems, or considered as having maturational lags on the basis of their performance on tests or in class, are actually suffering from some visual problem left undetected by the screening devices employed by most educational institutions today. If one considers that reading levels are the lowest in the most deprived segments of the population, where there is also the least amount of professional health care, it might be inferred that sociolinguistic factors are not the only reasons for the inferior reading performance. Certainly, it would be well if federal monies for remedial reading also included funding for professional vision screening, particularly in the preschool and primary years. It also seems incumbent upon the reading profession to ascertain whether a child has command of all mental, auditory, and visual faculties before referring the child to special instruction. (An update of visual screening techniques is appended.) (RL)

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The Relationship of Vision and Learning Disabilities

Introduction

In the winter of 1971-72, a joint organizational statement was issued by an ad hoc committee of the American Academy of Pediatrics and the American Academy of Ophthalmology with the assistance of the President and the Past President of the Division for Children with Learning Disabilities.[1] The subject was "the eye and visual training in the treatment of dyslexia and associated learning disabilities."

The first of the five conclusions listed in this paper was that "Learning disability and dyslexia, as well as other forms of school achievement, require a multi-disciplinary approach from medicine, education, and psychology in diagnosis. Eye care should never be instituted in isolation when a patient has a reading problem. Children with learning disabilities have the same incidence of ocular abnormalities, e.g. refractive errors and muscle imbalance, as children who are normal achievers and reading at grade level. <u>These abnormalities should be corrected.</u>" (The underlining is ours.)

Conclusion number two ended with the statement that "eye defects <u>do not cause reversals of letters, words, or numbers.</u>" Conclusion number three maintained that "no known scientific evidence supports claims for improving the academic abilities of learning-disabled or dyslexic children with treatment based solely on:

a. visual training (muscular exercises, ocular pursuit, glasses)

b. neurological organizational training (laterality training, balance board, perceptual training)

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The fourth conclusion continued "excluding ocular defects, glasses have no value in the specific treatment of dyslexia or other learning problems."

Although there is still a fifth conclusion, it is at this last important point which we would like to stop as the starting point for our paper. Much has already been written and said on the pros and cons of the Doman-Delacato[2.] "patterning" method and its relationship to learning problems as well as on the perceptual- motor approach espoused by Newell Kephart.[3.] We do not propose to enter this controversy, except incidentally.

What we are interested in is 1.) the extent to which undetected and/or uncorrected ocular defects simulate reading or other learning disabilities, and 2.) what measures can be taken to ascertain whether a child has some problem in the cognitive area which makes it difficult for him to process written symbols, or whether he simply cannot see the words. We shall attempt, in the process, to examine some of the typical reading "miscues" which can be involved.

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Donald Getz O.D.[4.], in a publication of the College of Optometrists in Vision Development, lists thirteen clues which point to a visual problem in young children, at least seven of which could be confused with a "dyslexia syndrome" of some type. These include reversals when reading, reversals when writing, transposition of letters and numbers, loss of place when reading line to line and word to word, use of the finger to maintain place, and omitting and/or confusing small words.

At this point the normal reaction would be to question whether

it is really necessary to pursue this matter any further, since the obvious procedure is to have the child's vision checked and take whatever measures seem indicated to remedy the situation, should visual defects be involved. Therein lies our major problem.

Although most, if not all schools, require vision screening for all students periodically, the good intentions often far outweigh the results. Both Getz[5.] and Albert Harris[6.] agree that the Snellen chart has many drawbacks, yet it is still used by many districts. Its sole value is in detecting those children who cannot see clearly at a distance of twenty feet, and it gives no information relative to the visual abilities needed to learn to read at a reading distance. Its only practical value in the classroom is in relationship to blackboard use. Harris tells us that "it fails to detect moderate degrees of farsightedness or astigmatism and fails completely to detect even severe cases of poor fusion and eye-muscle imbalance,"[7.] all of which, as we shall discuss later, play important roles in reading miscues.

Dr. Howard Coleman[8.] goes further and explains that, as a child becomes more and more near-sighted, his visual acuity, i.e. the sharpness or accuracy with which he visually perceives objects or images, decreases in almost direct linear relationship. Farsightedness, however, does not show this relationship to visual acuity, because many children have the focusing ability to allow them to compensate for their refractive error. Therefore, as Harris says, there would be no apparent effect on their reading of the Snellen chart.

Failure to read the Snellen chart acceptably, on the other hand, would still leave many questions unanswered, since simple near-sightedness may not be the only condition indicated. In anisometropia, the child has two different types of vision in any one of a number of combinations, e.g. one eye near-sighted, one eye far-sighted; one eye more far-sighted than the other, etc. In amblyopia, there is reduced visual acuity which is not explainable by the usual pathological or physiological reasons. And finally, there is always the possibility that some organic problem exists which is interfering with the transmission of light or the functioning of the retina. Therefore, any child who fails a visual acuity test, such as would be administered with a Snellen chart could be either myopic (near-sighted), hyperopic (far-sighted), possibly astigmatic (having blurred vision in half of each eye), possibly anisometropic or amblyopic, or may have some organic problem. Among those who pass, according to Coleman, will be found " not only all the normal children, but also more than half the children with visual problems."[9.] (We will see further statistics on this when we discuss the Orinda Study.) He confirms the fact that in the passing group will be cases of binocular coordination, or fusion, problems, hyperopia, astigmatism, low degrees of myopia and anisometropia.

To take care of the inadequacies of the Snellen Test, many schools have now switched to the Keystone Telebinocular or other stereoscopic-type instruments, which do provide for testing of eye-muscle balance at both near and distance. However, according to Dr. William Smith,[10.] writing in the

Review of Optometry, "an eye examination performed entirely by stereoscopic-type instruments is inadequate."[11] Apparently, the eyes of a subject looking into a telebinocular are held, as in a brace, in the "primary" position for seeing. Ocular muscles adjust accordingly, and discrepancies in motor performance do not manifest themselves, so that, for example, a vertical imbalance, in which one eye focuses higher than the other, often can be suppressed. The result of a vertical imbalance may be diplopia, double vision in lay language, or compensatory suppression of one to avoid the diplopia.

The child with a low degree of vertical imbalance(phoria) in attempting to decode, would see overlapping symbols. He would, as a result, tend to omit or confuse small words, lop off or mispronounce the ends of large words, and/or lose his place when reading line to line or word to word, ending up on either the line above or below. He would also probably use his finger to maintain his place.

The child with a high degree of diplopia would, of necessity, tend to suppress the non-dominant eye, affecting a torticollis, or head tilt, when reading or writing as a means of "hiding the unused eye. Sometimes turning the head away from the diplopia field, according to another article by Dr. Smith, "may also help to establish and maintain binocular single vision and egocentric localization."[12] Chin rise and chin drop may also be observed when paresis (partial paralysis) of the elevator and depressor muscles occurs.

"Suppression is a form of mental inhibition of visual

stimuli"[13] explains Dr. Smith. It is, therefore, both physiological and pathological i.e. a physical response to a functional problem.

The child who has problems with binocular vision usually moves his head rather than his eyes as he looks at successive words, disrupting the normal pattern of saccadic movements considerably. He might also be noticed to turn his book or paper to an extreme angle to match the angle at which his fixating eye hits the page. Obviously, neither situation makes for a very efficient reader.

Along with limitation of the field of observation, other weaknesses of the stereoscopic-type instruments include awareness of instrument limitation and inability to observe how the eyes are performing. For example, in amblyopia only central vision (foveal vision) is affected while peripheral vision is unaffected. Therefore sometimes turning the eye one degree can produce a "dramatic improvement" in visual acuity that is not obtainable with foveal vision, according to Dr. Smith. This would not be discernible using a telebinocular, since the eyes would be held braced in one position. On the other hand, there have been experiments performed using empty frames to limit the field of observation and hold the eyes in an orthophoric, or normal, position in situations where fusion could be improved. This is obviously an unorthodox procedure and so has not been highly touted.

Unconscious awareness of instrument limitation by the child will also cause an esophoria, or tendency of the eyes to converge ("toe-in") too much, to adjust and simulate normalcy.

Esophoric children, depending on the degree, are either diplopic or suppress, and the decoding problems mentioned above would again manifest themselves.

Nathan Flax O.D.,[14] in an article rebutting the aforementioned position paper by the American Academy of Ophthamology and Otolaryngology and the American Association of Ophthamology in conjunction with the American Academy of Pediatrics, points out that, although these groups use a paper by Bettman et al.[15] to support the statement that children with learning disabilities have the same incidence of ocular abnormalities as children who are normal achievers, statistics cited in this material seem to say exactly the opposite. For example, in comparing their controls with a group of 47 dyslexic children, they state," Yet, 42% of dyslexic children had foveal suppression detected by the four diopter prism test at distance or near, compared with 9% of the control." And"fifty two percent of dyslexic children showed gross jerkiness of their eyes in attempting to follow a pencil tip moved along a diagonal line. Only 11% of the controls had such jerkiness."[16]

The premise under which the medics are working, according to Flax, is that these conditions do not support a cause and effect relationship between ocular abnormalities and learning disabilities. On the contrary, they feel that both conditions are due to an underlying neuro-muscular abnormality frequently present in dyslexia. This stand is reminiscent of that taken by those who feel that perceptual motor problems also exist concurrently with learning problems and reject the develop-

mental theories of Kephart and Getman.

Katrina de Hirsch and Florence Feldman,[17] in discussing approaches to the prediction of reading failure, point out that "three visual competences are ..... essential to reading: visual efficiency, both structural and functional: visual discrimination- the ability to distinguish between shapes; and visual perception, which adds meaning to what is seen. Visual perception," they say,"depends on the two lower level competences."[18]

It is disheartening, albeit significant, that those segments of the population which have perhaps the greatest reading problems also receive the least amount of adequate visual care.[19] Dr. Alan Safir, M.D.,developer of the first marketed automatic refractor,used it to test poor minority children in New York schools and found "a predominance of inadequate eyeglass prescriptions." Thirty percent of the children were myopic, and less than a fourth wore adequate lenses. "Of the 109 myopic children, 26 had satisfactory correction, 49 had never been fitted with lenses and 28 had eyeglasses of very little power that did nothing to enhance noticeably acceptable visual acuity." In other words 83 or 76% of these children were probably "blind" to any learning material beyond their immedite desks.

It is interesting to note that Puerto Rican children aged eleven or older were two to three times as likely to be myopic as whites or blacks, particularly since practioners today tend to believe that myopia in not a congenital condition but is the result of some type of functional abuse of the eyes.[20]

An answer to this problem has been the development of the "myopter," a type of viewer which, when worn instead of glasses, "eliminates accomodation, convergence and stereopsis and thus completely transforms close work into distant work."[21.]

Myopia, incidentally, is well diagnosed by the school Snellen charts, according to Dr. Howard Coleman[22]; who also notes that myopic, or near-sighted, children are often excellent in reading skills. Evidently, their limited sphere of vision causes them to concentrate on those things which are closest.

As part of Dr. Coleman's West Warwick Study[23.] an analysis of the possible relationships between refractive errors and grade repetition was conducted on 131 children with myopia, 51 children with astigmatism and 117 children with hyperopia in grades one through four. It was found that while there was little relationship between myopia and grade repetition, male repeaters with astigmatism steadily increased from 10% in grade 2 to 33.3% in grade 4. Female repeaters did not follow this increase. Both males and females with hyperopia were noted to be repeaters in 20 to 33% of the cases in grades 1 through 4. No explanation seems to have been found as yet for the lack of relationship between female astigmatism and grade repetition. One can only guess that there may be some compensating factor in the female's faster developmental pattern at this stage which the male lacks.

Dr. Louis G. Hoffman[24.] went further and identified 20 visual skills which he felt were necessary for successful completion

of the Metropolitan Readiness Tests given to many kindergarten children, correlating their scores on the test battery with those in the visual skills. Results of the study showed a positive correlation of .79 between the two sets of scores.

The sample consisted of thirty children chosen randomly from two regular kindergarten classes in a predominately white, middle class, non-professional population. Vision testing was done by an optometrist within one week of administration of the the Metropolitan. Statistically significant relationships were found between Metropolitan Readiness scores and eleven skills. These included: "1. Binocular rotations.

2. Monocular rotations.
3. Monocular saccadic fixations.
4. Simultaneous perception at distance.
5. Fusion at distance.
6. Fusion at near.
7. Lateral phoria at near.
8. Visual efficiency O.D. (right eye) at near.
9. Visual efficiency O.S. (left eye) at near.
10. Accomodative flexibility.
11. Visual efficiency O.U. (both eyes) at near."[25]

Many of the visual skills involved here would also be needed for successful completion of the Jansky- de Hirsch battery, as both have similar elements.

If we analyze the skills listed above in relationship to either the Snellen chart or the Keystone Telebinocular, we can see that their detection would be vulnerable to the limitations

of these methods. Neither technique provides for the observation of rotations or fixations. The Snellen Test makes no provision for the testing of visual abilities at near. The Telebinocular, as we have discussed, limits the extent to which binocular efficiency, or fusion, can be evaluated.

It is not implied in this study that all of the kindergarteners involved in the above study were in possible need of glasses. Visual skills mature in the same way that motor and other sensory skills develop which affect readiness for learning. It is important, therefore, that a battery such as the Metropolitan or the Jansky-deHirsch when given, be correlated with the child's visual maturation. It is apparent from this study that failure in a readiness battery can be due to a generalized maturational lag of which the visual component can be an important factor, and so deserves consideration.

Further research in the development of a test of near point acuity in pre-school children to offset the weaknesses of the Snellen "illiterate E" chart has included the development of near point acuity test cards. A controlled study with one such card was recently reported in the American Journal of Optometry and Physiological Optics by its developers, Drs. Stuart B. Heller and David J. Trumbo.[26]

The experimenters produced a card on which twenty silhouettes of objects familiar to children were reproduced, with the size of each dependent upon the distance at which a child, not an adult, would perceive the figure. Inclusion of each object was dependent upon whether 90% of a group of 72 nursery school

children from varying ethnic backgrounds and socio-economic levels could identify it correctly. Size was then decided on the basis of "average perceptibility test distance." This was derived through a process in which the eyes of each of 20 children in the 5 to 6 year age range were blurred to 20/200 with a trial lens and the silhouette target moved slowly toward the subject until the first reported recognition of the object. Measurement was then made of the distance and related to the 33 centimeter, or 13 inch, viewing distance recommended for children as against a 40 centimeter, or 16 inch, distance for adults.

The final test card consists of a 10½ inch by 7 inch rectangular top attached to an 8 inch diameter wheel which rotates in a counter clock-wise direction. Each figure is shown individually to the child through one of two square windows which is surrounded by a gayly colored circus animal. Figures appear twice, once in a smaller and once in a larger acuity range, with the latter a check on whether the child's error is one of acuity or recognition.

The twenty figures are:

1. Shoe	11. Flower
2. Bird	12. Bottle
3. Duck	13. Fish
4. Boat	14. Hammer
5. Airplane	15. Spoon
6. Toothbrush	16. Telephone
7. Chair	17. Cup and saucer
8. Car	18. Rooster (turkey)
9. Gun	19. Umbrella
10. Horse	20. Circle

Though this test has the added component of perception, it would seem to have had all of the resulting contingencies ironed out. The figures used were originally taken from phonics texts and reading readiness workbooks used in the California schools on the preprimer and primer levels. It would seem to the observer to be quite culture fair, at least to the 90% level hoped for by the testers.

A great advantage of this card is the fact that the problem of directionality, an important component of the illiterate E chart or testing card, is eliminated and color cues are not required, since this card is in black and white.

It is relevant to what we reported above on the relationship of performance on the Metropolitan Readiness to visual maturation that Heller and Trumbo found "that 20/20 acuity is attainable by a large majority of preschoolers above three years of age."[27]

Since we introduced our subject on a note of discord between the two vision care fields of ophthamology and optometry, it is fitting that we conclude with a description of one of the major studies of efficient vision screening, conducted as a joint effort by practicioners from both these fields. The Orinda Vision Study[28], conducted under the auspices of the Contra Costa County Health Department in California, utilized a team of two ophthamologists from the Stanford University School of Medicine and two optometrists from the School of Optometry of the University of California, Berkeley.

The purpose of this study was to develop a vision screening program which "1.) could be achieved in an average community

and school system; 2) would find essentially all children with significant eye problems that most ophthamologists and optometrists would agree needed to be under professional care, whether therapy was to be recommended or not; 3) would avoid or minimize a conflict of opinion in each professional group or between the eye professions, or between the schools and the eye professions; 4) would minimize the over-referral problem with its attendant costs and complaints."[29.]

The population included was a group of over 1,000 children in grades 1 through 6 of the Orinda School District. Methods included and their effectiveness were:

1. The Massachusetts Vision Kit, administered by a trained nurse- missed half of those needing referral.
2. The Telebinocular, given by a nurse- found approximately half, but over referred many, even when failure on a re-test was required for referral.
3. The California State Recommended Test, with the teacher using the Snellen illiterate E, repeated through a +1.50 lens and a +2.00 lens, missed 3/4 of the correct referrals but kept referrals low if the cover test was eliminated. This test was later administered by a nurse.
4. The Modified Clinical Technique, performed by a qualified professional examiner- netted the least number of over and under-referrals for the three year study with an under- referral number of 31 out of an average of 1304 pupils as against 484 over-referrals and 110 under-referrals for the California State procedure.

The Telebinocular, utilized in 1955 and 1956, the second and third years of this three year study, was responsible for a total under-referral of 108 and a total over-referral of 900!

The Modified Clinical Technique (MCT) consisted of four series of tests including:

1. Visual acuity- using a table top projector type instrument with appropriate slides for both letters and illiterate E charts projected on a screen at 20 feet.
2. Cover Test- using the above projector showing a critical letter on the screen and an occluder to measure coordination.
3. Skiametry- utilizing a small movie projector and screen, a retinoscope, two pairs of +1.50 D.S. (Diopter Sphere) lenses in trial frames and a trial lens bar.
4. Inspection for organic problems- using a hand magnifier and an ophthalmoscope.

Calculations were also made of the cost per child of the various types of screening, taking into consideration the hourly wage for teachers and nurses, who are on a monthly fixed salary. Overhead and volunteer time were ignored.

In 1956 the costs of the various techniques were:

1. Massachusetts Vision Kit- 37¢ per pupil.
2. Telebinocular- 43¢ per pupil.
3. Modified Clinical Technique- 45¢ per pupil.
4. California State Recommended - 53¢ perpupil.

The cost of over-referrals was also considered and, in light

of this, the MCT was judged to be"the most efficient and economical screening procedure tested by far."[30] We would assume that, despite spiraling costs in the last twenty years, the relative costs of the various techniques would remain the same today.

Understandably, recommendations for future screening programs were for the utilization of a qualified professional examiner for all children at the first grade level and for all new entrants to the elementary with annual screening thereafter with the Snellen Test. This coupled with teacher observation was to provide the basis for referral to the MCT professional examiner during the period when he was screening new first graders.

Pertinent for our purposes in reading and education is the fact that a referral rate was also computed based on teacher observation each year, as well as parent and nurse observation. Teacher referrals over the three year period totaled 270 correct referrals, 431 under-referrals and 511 over-referrals. These figures were more favorable than those for nurses in the first two categories,which were 125 correct and 576 under-referrals. However, the latter group managed to keep the over-referral total down to 55, which may have been partially due to the fact that nurses do not have as much opportunity to observe children in their classroom activities. This may also help to explain the lower correct referral rate. In the third year of the study, correct referrals based on teacher observation exceeded thosebased on nurse observation, parent questionnaire, or the State recom-

mended procedure!

31.

Under the heading "Teacher Observation" in Appendix I of the study it is recommended that teacher observation for visual problems be done continuously. Four areas are delineated for particular attention. These include:

"1.Evidence of ocular abnormalities- crusted, red-rimmed, swollen lids, frequent styes, watering or bloodshot eyes, crossing of eyes.

2. Complaints of visual distress- sensitivity to light, burning or itching of eyes or lids, blurring or seeing double, words and lines running together, words jumping, headache.

3. Performance which suggests eye difficulties- rubbing eyes frequently, blinking frequently when reading, facial distortion when reading, closing or covering one eye or tilting head to one side when reading, or watching classroom movies, abnormal posture when doing close work, holding work too close or too far, irritable, short attention span, tenseness in reading.

4. Evidence of difficulty or dislike or inattention for reading, reading subjects, fine work."

Again we see, in the above recommendations, the importance of adequate visual abilities if the child is to be able first to decode reading materialthen start on his way to comprehension, which is, of course the ultimate goal in all reading.

More recently, in 1965, Dr. Harold L. Friedenberg, Chairman of the Committee on Visual Problems of Children and Youth of the American Optometric Association has also described a simliar program[32.] providing for the visual screening of preschool and school children. Professional vision care personnel are utilized with lay aides and secretaries doing the paper work. According to Dr. Friedenberg, 16% of preschool children screened as part of the Project Head Start require professional care.

The realities behind all of the statistics and theory which we have been describing can best be understood in terms of the individual child who has been presented to some reading specialist or clinician as a reading or learning disability case. Such a child was the young black girl designated in the files of the University of Pennsylvania Reading Clinic as case No. 74-04.

Our subject, aged 11 years and 7 months at the time of her admission to the Clinic, was in the sixth grade in school and reported to be reading on a second grade level. Results of both the University of Pennsylvania Informal Reading Survey and the Botel Cloze Comprehension paragraphs put her on an independent reading level of second grade and an instructional level of third. Scoring of the Botel Spelling Placement Test showed similar results. Frostig scores were normal for her age and grade in all but Test III, Constancy of Shape, on which her level was 6 years, 9 months. Test III is concerned with distinguishing between such geometric figures as circles

and ovals and squares and rectangles. The child also earned a Bender score of 4, which is equivalent to a chronological age of 8 years or the second grade in school. Her WISC scores were Performance,101 and Verbal, 86, understandable for a black ghetto child with poor reading skills.

The child's referral form indicated that her reading problem first became apparent in the first grade, at which time she was found to need glasses. From the start, however it was a constant battle to keep them on her. During her period of diagnosis in the Clinic, she left her glasses home frequently, finally losing them altogether, so that they were not replaced until the very last session. Her telebinocular screening was administered without glasses and, since she was erratic in keeping clinic appointments, never redone. Extant results were inconclusive.

For most of her testing, the young girl held her material quite close, squinting noticeably. Given a written exercise at her last session, she sat, this time with glasses, with her head down, close to the paper tilted in such a way that she seemed to be using only the left eye and with her paper slanted at a 45° angle. An analysis of the child's reading miscues included everything from mispronouncing the vowels in short words to an inability to decode correctly the endings of multi-syllable words. Neither was there any recognizable pattern to the types of miscues she made.

In this case, the examiner was at an advantage in that there was a professional record of the vision testing of

the student. A check with the family's optometrist revealed that this child had a hyperopic (far-sighted) astigmatism complicated by an esophoria, or toeing in, of the eyes. Her prescription was: right eye- +3, -3, axis 5; left eye- +3.50,-3.50, axis 170. There was a 4 diopter prism for the esophoria. With this type and degree of astigmatism, vertical lines would be very dark and horizantal lines difficult to see, so that it would be difficult to discriminate between similar geometric figures, let alone reproduce the gestalts called for in the Bender. The esophoria, at the very least, would require a tremendous amount of strain to perceive a clear image, and in this case, would probably result in a diplopia, or overlapping of images. In this child's case, the overlapping of images,or, to be more specific, letters or symbols, could well explain the miscues and their lack of any logical pattern.

Unfortunately, the student did not wear her glasses frequently enough for her eyes to adjust to the prescription and operate properly binocularly. Added to this is the fact that astigmatic lenses initially cause a flattening of images, and prolonged wear is necessary for the stimulus-response pattern to correct itself.

Conclusion

The question obviously becomes how many children designated as having learning or reading problems, or considered as having maturational lags on the basis of their performance on tests or in class, are actually suffering from some visual problem left undetected by the screening devices employed by most educational institutions today. If one considers that

reading levels are the lowest in the most deprived segments of our population, where also the least amount of professional health care is available, it might well be that the sociolinguistic factors are not the only ones responsible for the inferior reading performance. Certainly, it would be well if federal monies for remedial reading also included funding for professional vision screening, particularly in the preschool and primary years which are so important to future development.

It also seems incumbent upon us in the reading profession to ascertain beforehand whether a child referred for special instruction has command of all his faculties; mental, auditory and visual, so that he may best profit from our efforts in his behalf.

Our object in this paper has not been to suggest or prescribe the type of treatment needed by children with reading difficulties either caused or aggravated by visual problems. Neither did we intend to enter the controversies concerning the value of orthoptic or corrective treatment or those surrounding the use of cycloplegic drugs in examining the eye. These areas belong in the realm of professional eye care specialists, who, themselves, do not always agree on the best procedures and who, indeed, often base these procedures subjectively on the nature of the particular case at hand. It has merely been our intention to point up the close relationship between vision and learning disabilities and the magnitude of the problem which can exist when the former has been ignored.

We have attempted to prove that many so-called reading miscues could well be the result of ocular defects rather than learning disabilities and to point up the need for adequate screening programs at the earliest possible age so that these defects may be treated where they do exist. We hope that we have succeeded, at least to the extent that the teacher, and especially the reading specialist, is more aware of this dimension and of his or her responsibility to help make certain that those under his or her supervision have the optimal tools for learning, educationally and physically.

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January, 1981

Addendum

Since the foregoing paper was written, Dr. Howard N. Walton of the Southern California College of Optometry has developed and tested[1] a new visual screening procedure for use in the schools, currently referred to as the Walton Modified Telebinocular Technique (MTT).

Advantages of this technique over the Modified Clinical Technique (MCT) described here previously are detailed by Schubert and Walton[2] in The Reading Teacher.

According to the article, the MCT never enjoyed wide usage, despite the findings of the Orinda Study. This was mainly due to the fact that the screening method necessitated luring a team of optometrists and/or opthalmologists from their respective private practices.

Walton's MCT, on the other hand, can be administered by school nurses, teachers, psychologists, and clinicians. This is accomplished with the aid of a new stereogram card for the Standard Keystone Screening Tests[3], which use the Telebinocular. This card, developed by Walton, screens for amblyopia, nearsightedness, and astigmatism. In addition, Plus Lenses are used with three of the Keystone stereoscopic cards to test farsightedness. Scoring has also been revised on the muscular imbalance tests to minimize the tendency of the Keystone battery to over-refer, as occurred in the Orinda Study. More specifically, the MTT is based on the Standard Keystone Visual Skills Test set with one card added, cards 12, 13, and 14 removed, and cards 4½, 5, and 6 used with a Plus Lens.

In the double blind study which Walton and his associates

conducted using 102 Los Angeles school children in grades one through seven, results showed an agreement between the MCT and the MTT of 89.2% in the number of passes, failures, and ambiguous findings. They consider this evidence and the fact that the procedure is relatively inexpensive to be strong grounds for instituting its use in any school setting.

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Author's Note

In reviewing and comparing the visual problems identified by the Modified Clinical Technique (MTT) and the Walton Modified Telebinocular Technique (MTT), the author found no reference to testing for those skills which would be specifically needed for efficient reading; namely, various types of eye movements.

Correspondence with Dr. Walton confirmed this. Walton outlined five "eye movement systems:"

1. Position maintenance
2. Saccadic
3. Vergence
4. Pursuit
5. Compensatory

He explained that the first three systems are used in reading from the printed page. The pursuit system is used in reading moving material, such as signs when one is in a moving vehicle, and the compensatory system is relied upon in athletic or playground activities and in an individual who makes head movements while reading. The only eye movement system evaluated by the MTT is vergence, the extent to which the eyes move well together.

Walton indicated that, for <u>complete</u> screening, he recommends the use of two instruments: the Telebinocular and the Eye Trac. The Eye Trac continuously tracks and records on a graph the horizontal or vertical position of both eyes as the

subject reads a selection. Measured, according to the advertising literature, are:

-"fixations (forward eye stops)
- regressions (right to left or reverse eye movements)
- span or recognition (average number of words or word parts per eye pause)
- duration of fixations (average eye pause time)
- directional attack (percentage of left-to-right movement)
- rate (with comprehension)
- re-reading."

Operation is considered simple enough so that an aide or paramedical can do the testing.

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January 1981

Eye Trac 106. G+W (Gulf + Western) Applied Science Laboratories, 335 Bear Hill Road, Waltham, Massachusetts 02154